

Applic. No. 10/533,812  
Amdt. dated December 30, 2005  
Reply to Office action of October 4, 2005

Claim Amendments

This listing of the claims will replace all prior versions, and listings, of claims in the application:

Claims 1-14 (cancelled).

Claim 15 (currently amended): Injection An injection valve with a capacitive valve lift sensor for an internal combustion engine, the valve comprising:

a nozzle body formed with a valve seat;

a valve needle longitudinally guided in and electrically insulated from said nozzle body, said valve needle having a first end assigned to said valve seat and a second end;

said valve needle and said valve seat forming respective electrodes of a capacitor connected in an electric circuit, said capacitor having a capacitance varying with a valve lift of said valve needle; and

an electrically conductive injector body connected to said electric circuit and carrying said nozzle body with said valve seat, and wherein said second end of said valve needle is connected to said electric circuit;

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said electric circuit having a voltage interface via a conductor passed in an insulated fashion in an axial hole formed in said injector body, said conductor being connected to an electrically conductive contact spring disposed in an insulated fashion in said injector body, said contact spring being supported such that contact is established on a bottom of a head of a conductive injector piston, being pressed for establishing contact against said second end surface of said valve needle facing away from said valve seat.

Claim 16 (cancelled).

Claim 17 (previously presented): The injection valve according to claim 15, wherein said injector body is configured as an intermediate disk above an end surface of said valve needle facing away from said valve seat and wherein an electrically conductive contact element is disposed on a side of said intermediate disk facing away from said valve seat for an electrical connection between said conductor and said contact spring, said contact element is electrically insulated from said injector body and said intermediate disk, and a valve-side end of said contact spring is supported on said contact element.

Claim 18 (currently amended): The injection valve according

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to claim [[16]] 15, which comprises a seal at a start and an end of said axial hole.

Claim 19 (currently amended): ~~The injection valve according to claim 15, wherein~~

An injection valve with a capacitive valve lift sensor for an internal combustion engine, the valve comprising:

a nozzle body formed with a valve seat;

a valve needle longitudinally guided in and electrically insulated from said nozzle body, said valve needle having a first end associated with said valve seat and a second end;

said valve needle and said valve seat forming respective electrodes of a capacitor connected in an electric circuit, said capacitor having a capacitance varying with a valve lift of said valve needle; and

an electrically conductive injector body connected to said electric circuit and carrying said nozzle body with said valve seat, and said second end of said valve needle being connected to said electric circuit;

said electric circuit passes passing via a nozzle retaining

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spring disposed in an electrically insulated fashion in said injector body, said nozzle retaining spring presses pressing said valve needle against said valve seat, an end of said nozzle retaining spring facing away from the valve seat [[is]] being supported on an adjusting disk, said adjusting disk [[is]] being connected electrically to a terminal with further connections, and [[is]] being supported on a valve side thereof on a conductive injector piston ~~that is~~ pressed such that contact is established against said second end surface of said valve needle .

Claim 20 (currently amended): The injection valve according to claim 15, wherein said valve needle and said injector piston [[(9)]] are formed with an insulating layer at least on part of surfaces thereof that do not serve to establish contact.

Claim 21 (previously presented): The injection valve according to claim 19, which further comprises a control piston having a valve-side end surface pressing on a central region of a head surface of said injector piston facing away from said valve seat, and an insulating layer disposed on a head surface of a lift adjustment pin.

Claim 22 (currently amended): The ~~injection valve according to~~

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claim 15, wherein

An injection valve with a capacitive valve lift sensor for an internal combustion engine, the valve comprising:

a nozzle body formed with a valve seat;

a valve needle longitudinally guided in and electrically insulated from said nozzle body, said valve needle having a first end associated with said valve seat and a second end;

said valve needle and said valve seat forming respective electrodes of a capacitor connected in an electric circuit, said capacitor having a capacitance varying with a valve lift of said valve needle; and

an electrically conductive injector body connected to said electric circuit and carrying said nozzle body with said valve seat, and said second end of said valve needle being connected to said electric circuit, said injector body [[is]] being configured as an intermediate disk above said second end surface of said valve needle and an axial annular collar [[is]] being configured on the end surface of said valve needle, and a stop surface formed as a counter-collar configured on a bottom of said intermediate disk, and wherein the bottom of said intermediate disk is formed with an

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insulating layer at least in an area of said stop surface.

Claim 23 (previously presented): The injection valve according to claim 20, wherein said electrically insulating layer is formed of a material selected from the group consisting of diamond-like carbon, aluminum oxide, and zirconium oxynitrite.

Claim 24 (previously presented): The injection valve according to claim 15, wherein an actual valve lift ( $H$ ) is determined by measuring a voltage drop  $U_{inj}$  in each instance at a complex resistance substantially formed between said nozzle needle and said nozzle body, and an alternating voltage is applied as an operating voltage  $U_b$ .

Claim 25 (previously presented): The injection valve according to claim 15, wherein an axial position of said nozzle needle is a function of a determined capacitance and resistance between said injector body and at least one valve part.

Claim 26 (previously presented): The injection valve according to claim 24, wherein a time when said nozzle needle lifts off said valve seat depends on a change in capacitance between said nozzle needle and said nozzle body.

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Claim 27 (previously presented): The injection valve according to claim 24, wherein a time when said nozzle needle lifts off said valve seat depends on a change in capacitance between said nozzle needle and said nozzle body and is detectable by a determined capacitance reduction.

Claim 28 (previously presented): The injection valve according to claim 15, wherein a wear rate of an insulating layer between said nozzle needle and said nozzle body is a function of an ohmic resistance determined between said nozzle needle and said nozzle body.

Claim 29 (previously presented): The injection valve according to claim 28, wherein increased wear of the insulating layer between said nozzle needle and said nozzle body is indicated by a reduced ohmic resistance between said nozzle needle and said nozzle body.

Claim 30 (currently amended): The injection valve according to claim 21, wherein an inside of said nozzle body and said nozzle needle are coated with a further insulating layer at least in a region of said valve seat.